US009256869B2

(12) **United States Patent**
Nandagopal

(10) **Patent No.: US 9,256,869 B2**
(45) **Date of Patent: *Feb. 9, 2016**

(54) **AUTHENTICATION AND VERIFICATION SERVICES FOR THIRD PARTY VENDORS USING MOBILE DEVICES**

(71) Applicant: **Alcatel Lucent**, Boulogne-Billancourt (FR)

(72) Inventor: **Thyagarajan Nandagopal**, Edison, NJ (US)

(73) Assignee: **Alcatel Lucent**, Boulogne-Billancourt (FR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **14/594,771**

(22) Filed: **Jan. 12, 2015**

(65) **Prior Publication Data**

US 2015/0154586 A1 Jun. 4, 2015

Related U.S. Application Data

(63) Continuation of application No. 11/345,695, filed on Feb. 2, 2006, now Pat. No. 8,934,865.

(51) **Int. Cl.**
H04M 3/42 (2006.01)
G06Q 20/32 (2012.01)
(Continued)

(52) **U.S. Cl.**
CPC ***G06Q 20/3229*** (2013.01); ***G06Q 20/10*** (2013.01); ***G06Q 20/32*** (2013.01); ***G06Q 20/322*** (2013.01); ***G06Q 20/325*** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC H04W 12/06; H04W 8/245; H04W 4/14; H04W 72/005; H04W 80/04; H04L 29/08108; H04L 2012/5607; H04L 63/05; G07F 7/10; G07F 7/1075; G06Q 20/423; G06Q 20/32; G06Q 20/322; G06Q 20/325; G06Q 20/347; G06Q 20/47
USPC 455/411, 414.1, 418–420, 466; 370/310.2, 312, 328; 715/202; 705/39, 705/64; 713/168
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,610,105 B1 8/2003 Martin et al.
6,731,731 B1 5/2004 Ueshima
(Continued)

FOREIGN PATENT DOCUMENTS

EP 1 065 634 A1 1/2001
EP 1 443 475 A1 8/2004
(Continued)

OTHER PUBLICATIONS

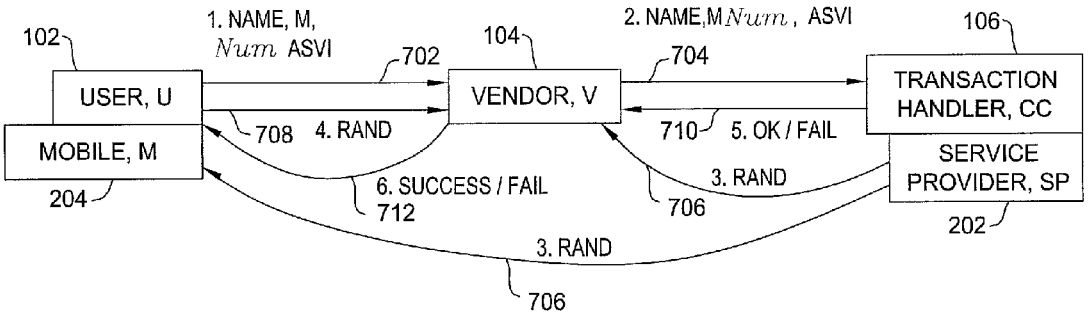
International Search Report and Written Opinion in corresponding PCT/US2007/002996, Jul. 2007, Lucent Technologies Inc.
(Continued)

Primary Examiner — Steve D Agosta
(74) *Attorney, Agent, or Firm* — Wall & Tong, LLC

(57) **ABSTRACT**

A method to provide authentication services to third party vendors by a service provider hosting an authentication, authorization and accounting (AAA) server or a similar device that can authenticate users for some other service. This method enables easy and substantially error-free end-user authentication, which forms the basis for enabling electronic transactions (e.g., web-based) that are less vulnerable to fraud.

18 Claims, 8 Drawing Sheets



(51) **Int. Cl.**

G06Q 20/34	(2012.01)
G06Q 20/42	(2012.01)
G07F 7/10	(2006.01)
G06Q 20/10	(2012.01)
G06Q 20/40	(2012.01)
H04W 12/06	(2009.01)

(52) **U.S. Cl.**

CPC ***G06Q20/3227*** (2013.01); ***G06Q 20/347*** (2013.01); ***G06Q 20/4014*** (2013.01); ***G06Q 20/42*** (2013.01); ***G06Q 20/425*** (2013.01); ***G07F 7/10*** (2013.01); ***G07F 7/1075*** (2013.01); *H04W 12/06* (2013.01)

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,980,970	B2	12/2005	Krueger et al.
7,043,635	B1	5/2006	Keech
2002/0059146	A1	5/2002	Keech
2004/0203595	A1	10/2004	Singhal

FOREIGN PATENT DOCUMENTS

EP	1 538 571	A	6/2005
FR	2 812 424	A	2/2002
JP	2001-45562		2/2001
JP	2001-283121		10/2001
KR	2003-0036766		5/2003
WO	WO 01/55984	A	8/2001
WO	WO 02/21463	A2	3/2002
WO	WO 03/015043	A	2/2003
WO	WO 2005/001670	A2	1/2005
WO	WO 2005/024677		3/2005

OTHER PUBLICATIONS

Nov. 9, 2010 Office Action in CN 200780004215.9, Lucent Technologies Inc. Applicant, 3 pages.

Dec. 27, 2011 Office Action in CN 200780004215.9, Lucent Technologies Inc. Applicant, 3 pages.

Sep. 5, 2012 Office Action in CN 200780004215.9, Lucent Technologies Inc. Applicant, 3 pages.

Jan. 4, 2013 Office Action in CN 200780004215.9, Lucent Technologies Inc. Applicant, 4 pages.

Feb. 13, 2012 Office Action in JP 2008-553390, Alcatel-Lucent USA Inc., Applicant 4 pages.

Dec. 18, 2012 Office Action in JP 2008-553390, Alcatel-Lucent USA Inc., Applicant 5 pages.

Mar. 27, 2013 Office Action in KR 10-2008-7018267, Alcatel-Lucent USA Inc., Applicant, 4 pages.

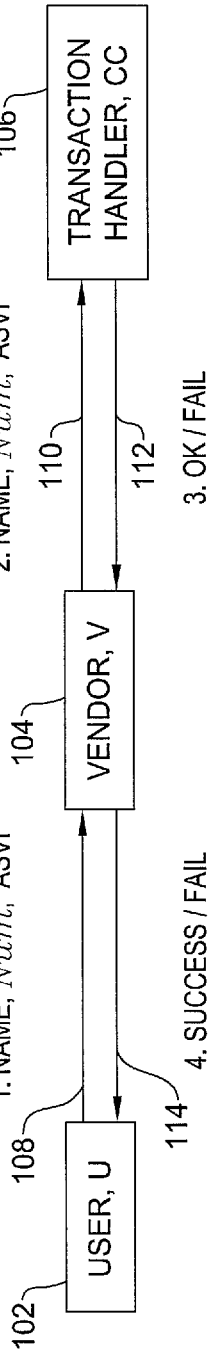


FIG. 1
(PRIOR ART)

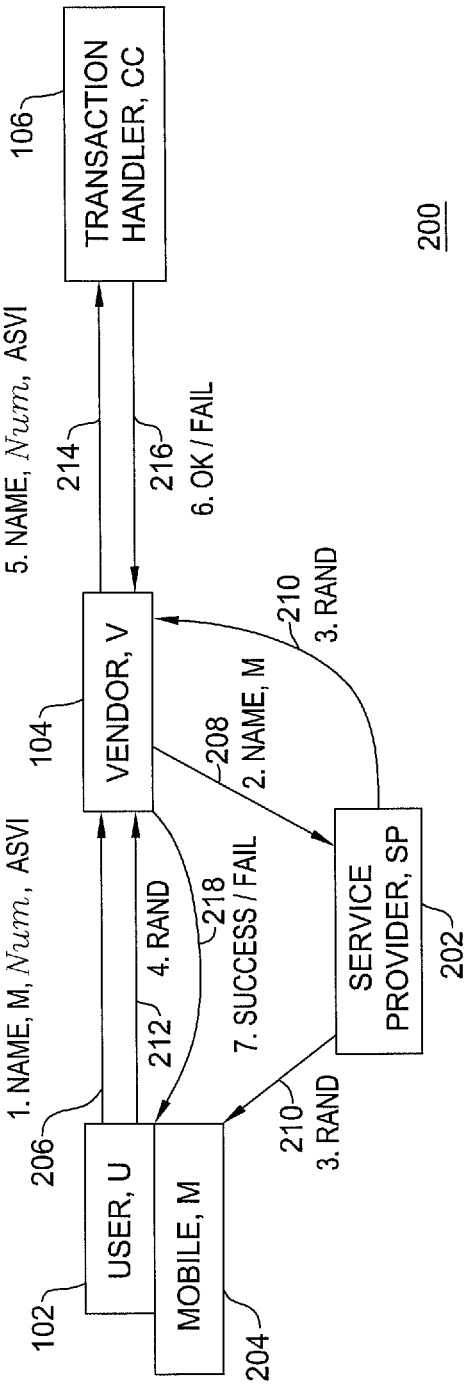

TRANSACTION HANDLER, CC
106
VENDOR, V
104
SERVICE PROVIDER, SP
202
USER, U
102
MOBILE, M
204
200
1. NAME, M, Num, ASVI
206
2. NAME, M
208
3. RAND
210
4. RAND
212
5. NAME, Num, ASVI
214
6. OK / FAIL
216
7. SUCCESS / FAIL
218

FIG. 2

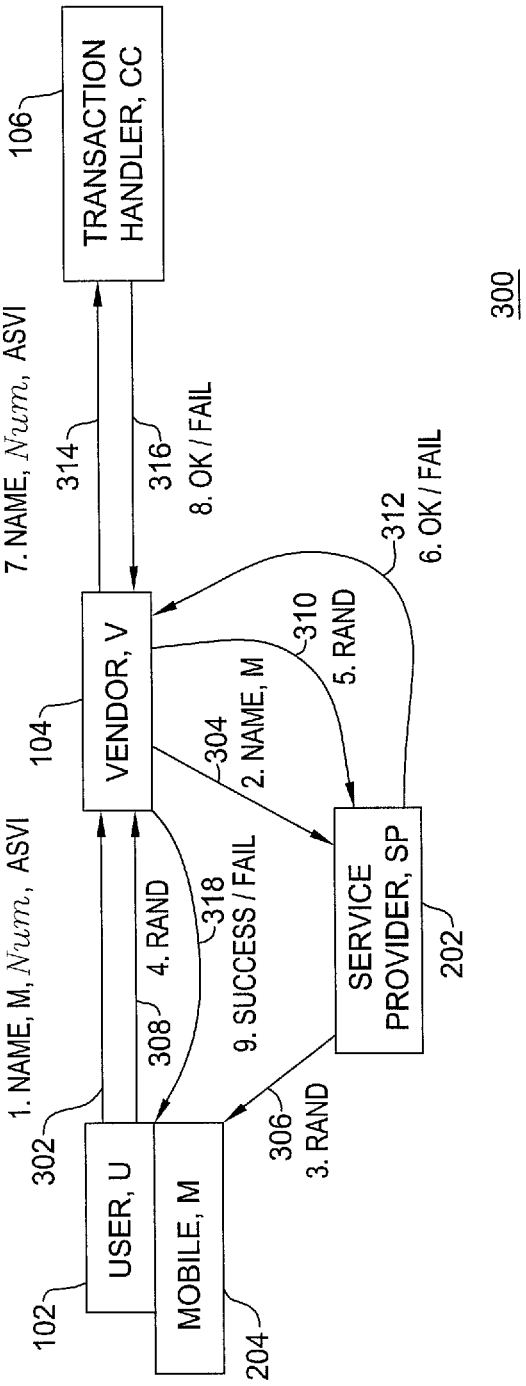

TRANSACTION HANDLER, CC
106
VENDOR, V
104
USER, U
102
MOBILE, M
204
SERVICE PROVIDER, SP
202
1. NAME, M, Num, ASVI
302
2. NAME, M
304
3. RAND
306
4. RAND
308
5. RAND
310
6. OK / FAIL
312
7. NAME, Num, ASVI
314
8. OK / FAIL
316
9. SUCCESS / FAIL
318
300

FIG. 3

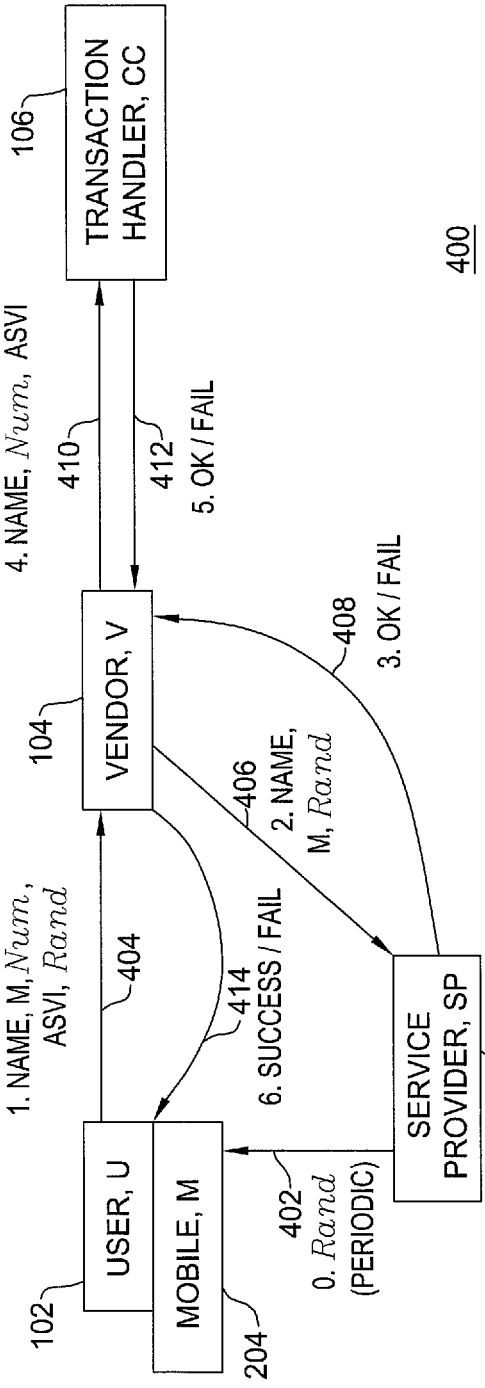

400
TRANSACTION HANDLER, CC
106
VENDOR, V
104
USER, U
MOBILE, M
102
204
SERVICE PROVIDER, SP
202
0. Rand (PERIODIC)
402
1. NAME, M, Num, ASVI, Rand
404
2. NAME, M, Rand
406
3. OK / FAIL
408
4. NAME, Num, ASVI
410
5. OK / FAIL
412
6. SUCCESS / FAIL
414

FIG. 4

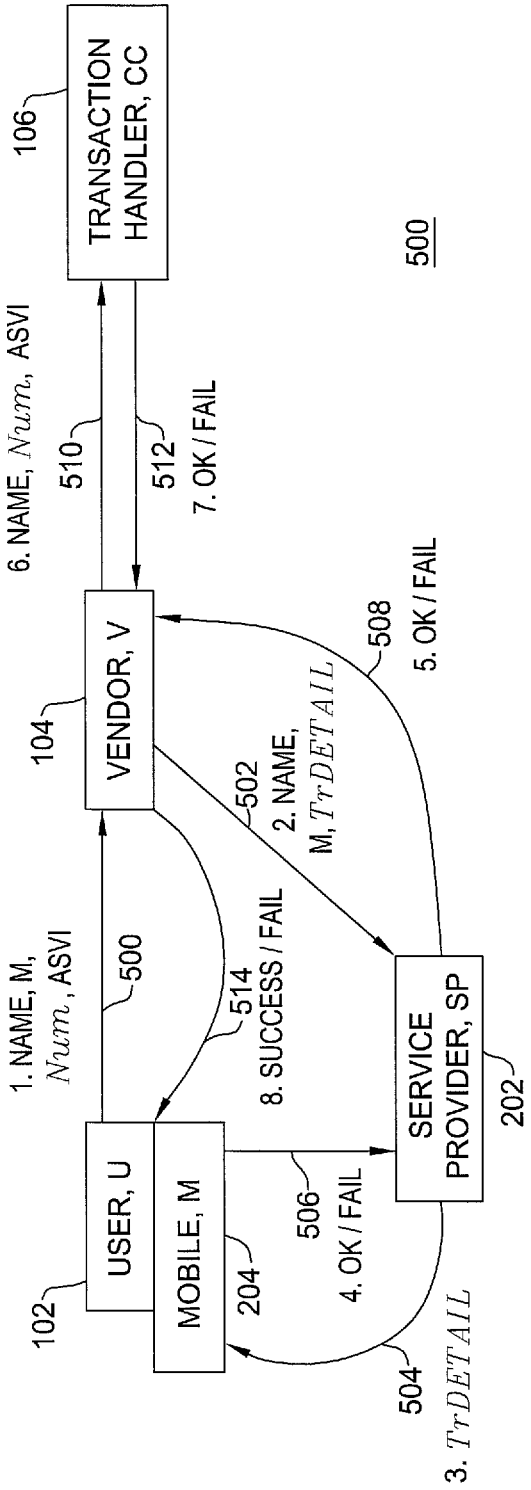

TRANSACTION HANDLER, CC
106
VENDOR, V
104
USER, U
102
MOBILE, M
204
SERVICE PROVIDER, SP
202
500
1. NAME, M, Num, ASVI
6. NAME, Num, ASVI
510
512
7. OK / FAIL
502
2. NAME, M, $TrDETAIL$
504
3. $TrDETAIL$
506
4. OK / FAIL
508
5. OK / FAIL
514
8. SUCCESS / FAIL

FIG. 5

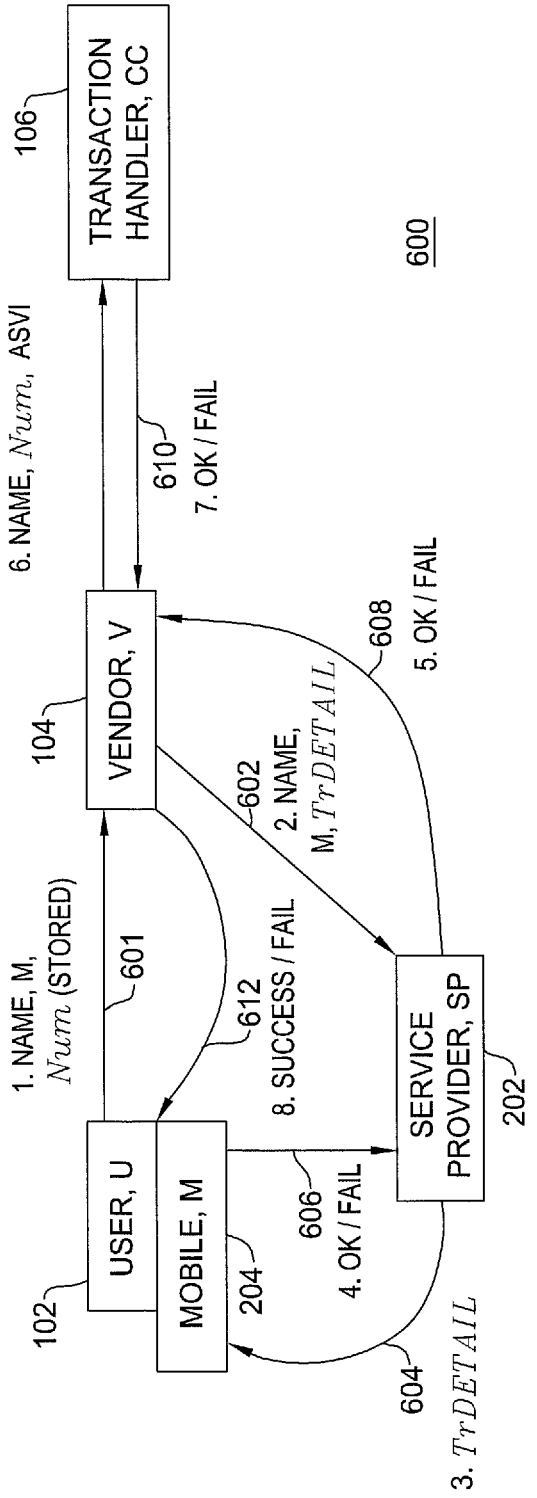

TRANSACTION HANDLER, CC
106
VENDOR, V
104
USER, U
102
MOBILE, M
204
SERVICE PROVIDER, SP
202
600
1. NAME, M, Num (STORED)
601
6. NAME, Num, ASVI
610
7. OK / FAIL
602
2. NAME, M, $TrDETAIL$
608
5. OK / FAIL
612
8. SUCCESS / FAIL
606
4. OK / FAIL
604
3. $TrDETAIL$

FIG. 6

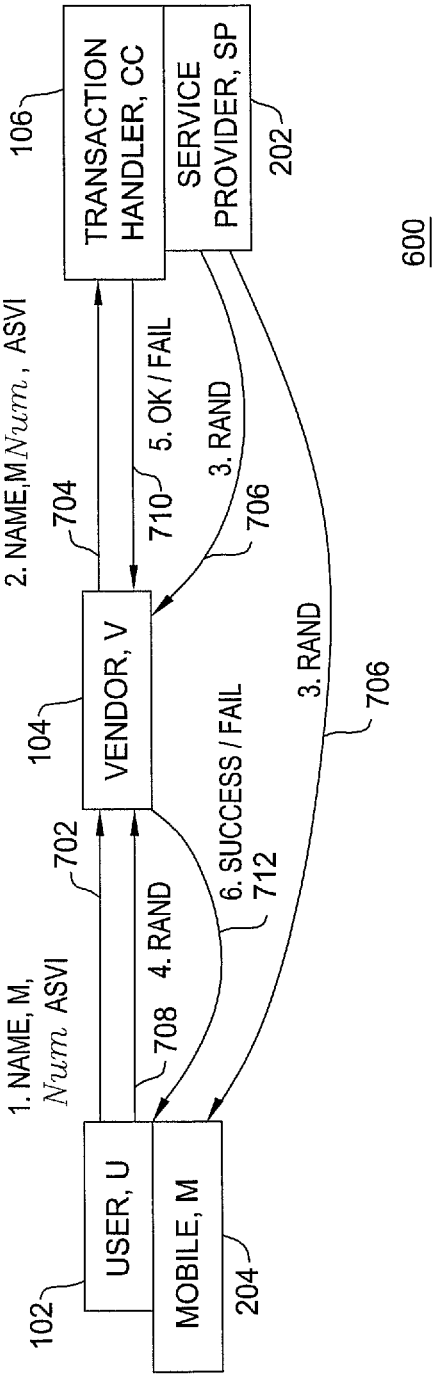

TRANSACTION HANDLER, CC
106
SERVICE PROVIDER, SP
202
600
2. NAME,M,Num, ASVI
704
5. OK / FAIL
710
3. RAND
706
VENDOR, V
104
3. RAND
706
6. SUCCESS / FAIL
712
702
1. NAME, M, Num ASVI
4. RAND
708
USER, U
102
MOBILE, M
204

FIG. 7

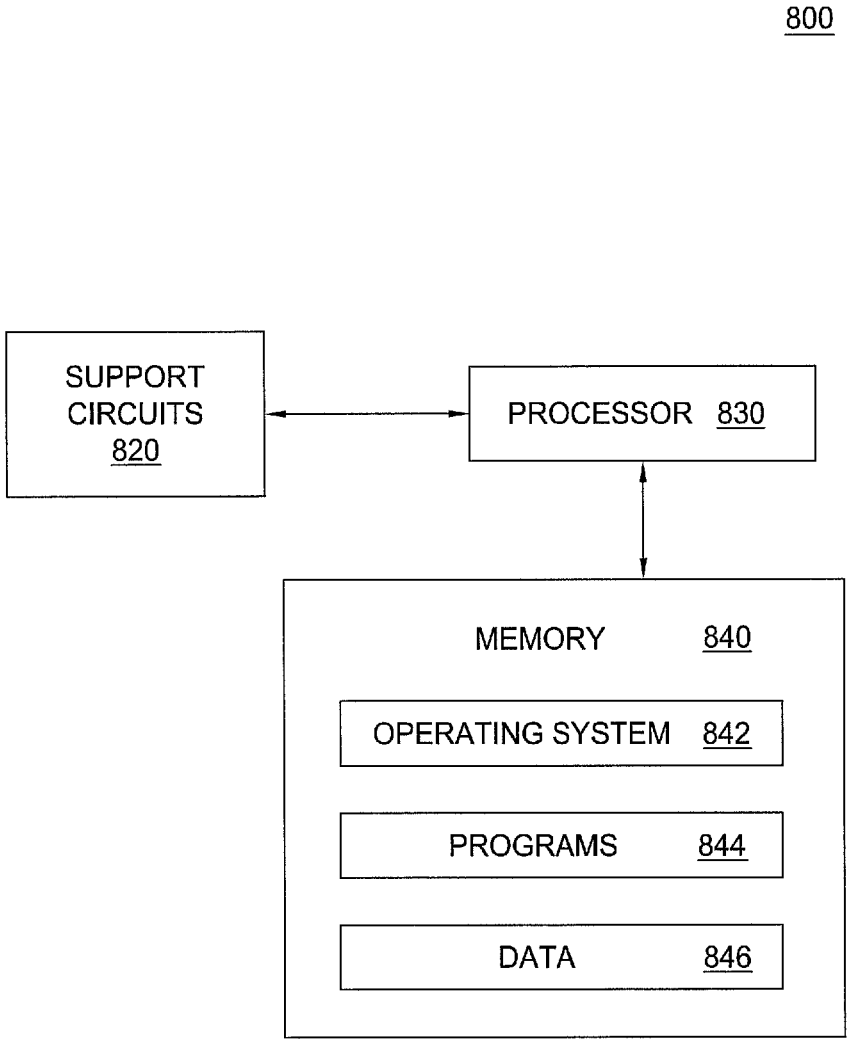

800
SUPPORT CIRCUITS 820
PROCESSOR 830
MEMORY 840
OPERATING SYSTEM 842
PROGRAMS 844
DATA 846

FIG. 8

AUTHENTICATION AND VERIFICATION SERVICES FOR THIRD PARTY VENDORS USING MOBILE DEVICES

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 11/345,695 filed on Feb. 2, 2006, AUTHENTICATION AND VERIFICATION SERVICES FOR THIRD PARTY VENDORS USING MOBILE DEVICES, which is hereby incorporated herein by reference.

FIELD OF THE INVENTION

The present invention relates generally to the fields of communication protocols and internetworking and, in particular, relates to security, authentication, e-commerce, wireless networks, buyers and sellers, and mobile computing.

BACKGROUND OF THE INVENTION

Vendors would prefer to improve the shopping experience for consumers by making purchase transactions more secure, without forcing consumers to swipe their credit cards and provide identification to verify their identities. Also, fraud and identity theft have become pervasive problems.

Traditional world wide web electronic transactions involve the keying of an end-user's name and credit/debit card number with some associated auxiliary security verification information (ASVI) (e.g., the card verification value (CVV) number, user address, billing zip code, year of birth of the user, etc.) into a vendor's webpage for billing. The vendor passes this information to the transaction handler (or payment gateway), who verifies the authenticity of the provided information and conveys the result to the vendor. The vendor then completes the transaction by billing the user.

While the ASVI information is supposed to be known only to the end-user, practical constraints force the user to have a fixed set of this information. This information could be knowingly or inadvertently stored at many points in the network by some vendors with whom the user has transacted in the past. In addition, ASVI information is stored by the transaction handler (or payment gateway). This data is, therefore, more vulnerable to theft and compromise. The identity of the user can be impersonated by anyone in possession of the ASVI information in addition to the credit/debit card information.

SUMMARY

Exemplary embodiments of the present invention provide authentication and verification services for third party vendors using mobile devices, eliminating the need for the vendor to solely rely on the ASVI information in order to authenticate the user.

One embodiment is a method for performing authentication. A name and a mobile device identifier are received from a vendor. It is verified that the name received from the vendor is the same as the name of the owner of the mobile device that was identified by the mobile device identifier. A new data string is generated and the same data string is sent to both the vendor and the mobile device. The user's identity is verified by determining that the data string received by the vendor is the same as the data string received by the mobile device. Another embodiment is a computer readable medium storing instructions for performing this method.

In another embodiment of a method for performing authentication, a name and a mobile device identifier are received from a vendor. It is verified that the name received from the vendor is the same as the name of the owner of the mobile device that was identified by the mobile device identifier. A data string is sent to the mobile device, which is passed to the vendor. The data string can be randomly generated. Then, the same data string is received from the vendor. The user's identity is verified by determining that the two data strings are the same. Another embodiment is a computer readable medium storing instructions for performing this method.

In yet another method for performing authentication, a first data string is sent to a mobile device. A name, a mobile device identifier, and a second data string are received from a vendor. It is verified that the name received from the vendor is the same as the name of the owner of the mobile device that was identified by the mobile device identifier. The user's identity is verified by determining that the first data string is the same as the second data string that was sent to the mobile device. Another embodiment is a computer readable medium storing instructions for performing this method.

In still another method for performing authentication, a name, a mobile device identifier, and a set of transaction information is received from a vendor. It is verified that the name received from the vendor is the same as the name of the owner of the mobile device that was identified by the mobile device identifier. The transaction information is sent to the mobile device, which can be optionally verified by the user. Another embodiment is a computer readable medium storing instructions for performing this method.

BRIEF DESCRIPTION OF THE DRAWINGS

The teachings of the present invention can be readily understood by considering the following detailed description in conjunction with the accompanying drawings, in which:

FIG. **1** is a block diagram that shows a traditional electronic transaction;

FIG. **2** is a block diagram that shows an exemplary embodiment of a method for authentication and verification services for third party vendors using mobile devices;

FIG. **3** is a block diagram that shows another exemplary embodiment of a method for authentication and verification services for third party vendors using mobile devices;

FIG. **4** is a block diagram that shows yet another exemplary embodiment of a method for authentication and verification services for third party vendors using mobile devices;

FIG. **5** is a block diagram that shows still another exemplary embodiment of a method for authentication and verification services for third party vendors using mobile devices;

FIG. **6** is a block diagram that shows an exemplary embodiment of a method for automatic billing services with user verification for third party vendors using mobile devices;

FIG. **7** is a block diagram that shows yet another exemplary embodiment of a method for authentication and verification services; and

FIG. **8** is a high level block diagram showing a computer.

To facilitate understanding, identical reference numerals have been used, where possible, to designate identical elements that are common to the figures.

DETAILED DESCRIPTION OF THE INVENTION

The present invention will be primarily described within the general context of embodiments of methods and system for authentication and verification services for third party vendors using mobile devices. However, those skilled in the

art and informed by the teachings herein will realize that the invention is generally applicable to any kind of device capable of receiving information (e.g., personal digital assistants, laptops, cell phones, mobile or portable device, or other computing devices), authentication service, authorization service, accounting service, verification service, automatic or manual billing service, security application, transaction types, selling, buying, shopping, sellers, vendors, merchants, shops, websites, buyers, consumers, banks, credit cards, other commercial and financial entities, and any other devices, services, and types of networks.

There must be a better way for vendors to improve the shopping experience for consumers by making transactions faster and easier, without forcing consumers to swipe their cards and provide identification to verify their identities. Also, fraud and identity theft have become pervasive problems. At the same time, most people now always carry mobile phones or other portable devices. Increasingly, mobile phones and other portable devices have more and more functionality. In the case of identity theft, the thief has access to the user's information (e.g., credit card number) but the user is not aware that the thief has access. However, nobody can use a mobile device unless they have actual physical possession of the mobile device. A mobile phone is one example of such a mobile device. Like a driver's license, a mobile phone is something a person always has in his or her possession and, thus, is available for identification purposes. If it were just a number, like a social security number, anyone could use it just by knowing the number, without having possession of the physical social security number card. The mobile phone is in close physical proximity with the user. Unlike a passive driver's license, the mobile phone and other mobile devices not only provide identification, but also send and receive information, such as text messages.

One exemplary embodiment is a method for providing authentication services to third party vendors that eliminates the need for a vendor to solely rely on ASVI information in order to authenticate the user. Authentication services are provided by a service provider hosting an authentication, authorization and accounting (AAA) server, a billing records server, or a similar device to authenticate users for some other service. This enables easy and substantially error-free end-user authentication that forms the basis for enabling electronic transactions (e.g., web-based) and other services that are less vulnerable to fraud.

Consider a transaction in a supermarket where a counter-clerk visually authenticates a user using his photo identity card (e.g., driver's license) as an authentication mechanism in addition to the ASVI information. Another authentication mechanism that is available in exemplary embodiments for a user that always carries a mobile device. The mobile device is served by a service provider. The service provider may provide wireless service or some connectivity or other service to the user. Alternatively, the service provider may be a third party providing authentication and verification service for a vendor. For example, a corporate entity may provide email service to the user. The service provider has an authentication server, typically as part of an AAA server that authenticates the mobile device carried by the user. Specifically, the user account is associated with the user's name (and optionally the user's address) and information and an identifier specific to the mobile device, (e.g., subscriber identity module (SIM) or electronic serial number (ESN)). Whenever the mobile device is connected to the network of the service provider, this authentication can be performed and periodically verified. Of course, the user needs to immediately notify the service provider if the mobile device is stolen or lost.

FIG. **1** shows a traditional electronic transaction **100** between a user (U) **102** and a vendor (V) **104** (e.g., a grocery store, an e-commerce store, a billing agent, or any person or organization that accepts an alternative payment in lieu of cash) via a transaction handler (CC) **106**, (e.g., a bank, a credit card company, a payment gateway, or any entity handling and verifying financial transactions, or a combination of these). In step 1, the user **102** sends his name and optionally his address, both of which are denoted by "NAME" in FIG. **1**, and account number denoted by "Num" (e.g., the credit/debit card number, or other account number) along with the ASVI information **108** (e.g., the card verification value (CVV) number, billing address, billing zip code, year of birth of the user, etc.) to the vendor **104**, who passes this information **110** to the transaction handler **106** in step 2. This information **110** is verified by the transaction handler, who sends an okay or fail message (step 3) **112** to the vendor **104** regarding the authenticity of the billing information provided and, in addition, the authenticity of the user credentials, (not the authenticity of the user). Upon receiving the message **112**, the vendor **104** successfully processes the transaction (step 4) **114** and subsequently provides the service(s) to the user **102**.

One problem with the traditional electronic transaction **100** is that the user **102** could be faking the credentials (i.e., account number and ASVI information) and both the vendor **104** and the transaction handler **106** are powerless to detect it. Additional authentication involves storage of more personal information about the user **102**, such as biometric data. However, most additional authentication is either prohibitively expensive, or not portable, or not easy to use, or significantly erodes the privacy of the user **102**. Even this additional authentication is subject to abuse, because this information is usually stored at the transaction handler **106** and, hence, can be stolen. A public key infrastructure (PKI) can be used for end-user authentication, where the user **102** encodes his information with his private key. However, PKI is not used pervasively by any party in traditional electronic transactions, due to its inconvenience and privacy considerations.

In the traditional electronic transaction **100**, the authentication service is provided by the transaction handler **106**. Again, the transaction handler **106** authenticates only user credentials, not the user. There is a need for an authentication service that is separate from the transaction handler, which provides more control for the vendor, helping the vendor **104** verify the identity of user **102**. ASVI information is often stored in a database by the transaction handler. So, a thief could steal the ASVI information in the database and pretend to be a user in a transaction with a vendor. When the fraud comes to light, the vendor is stuck with all the fraudulent charges. By contrast, exemplary embodiments add an additional authentication mechanism that is substantially simple, fool-proof, and easy to use. One such exemplary embodiment is outlined in FIG. **2**.

FIG. **2** shows an exemplary embodiment **200** of a method for authentication and verification services for third party vendors using mobile devices. This exemplary embodiment introduces a third party, the service provider (SP) **202** and a third party authentication service that can be used by a vendor (V) **104**. In this exemplary embodiment, the user (U) **102** sends his name, (optional address) number, and ASVI information **206** as usual, but also sends the identity of the mobile device (M) (e.g., M=cell phone number, SIM card number, or ESN number) to the vendor (V) **104** (step 1 **206**). The vendor identifies the service provider **202**, which can authenticate M and sends the service provider the information (step 2 **208**), i.e., name (optional address) and M. The vendor sends this information with equipment, such as a cash register machine,

a personal computer (PC), a credit card verification machine, or a standalone device. This equipment is provided to the vendor by the service provider, in one embodiment. In another embodiment, the information is transmitted electronically by the vendor to the service provider. The service provider **202** checks if the identity of the mobile device, M, is authenticated against a user with the same name (and optionally address) as user **102**. In other words, the service provider checks that the person with that name (and optionally address) is the same person who owns the mobile device identified by M. If so, then the service provider sends the mobile device **204** and the vendor a data string of information, rand, (step 3 **210**). In another embodiment, the data string can be generated at random by the service provider.

The data string is not stored and is generated at this point in each transaction. The data string does not necessarily follow any pattern, but this exemplary embodiment does not preclude that. However, a data string affords more security. The data string can be any sequence of characters, numbers, images, sounds, or any randomly chosen piece information capable of being sent from the service provider and received by both the mobile device **204** and the vendor **104**.

The user **102** receives the data string on his mobile device **204** and, then, sends the data string to the vendor **104** (step 4 **212**). The vendor **104** verifies this with the string received from the service provider (previously in step 3 **210**) and if it matches, then the vendor **104** is assured that the user **102** is indeed in possession of his registered mobile device **204** and, therefore, who he claims to be according to the service provider **202**. Now, the vendor **104** proceeds with the rest of the transaction with the transaction handler **106**. If that part of the transaction succeeds as well, the vendor **104** has authenticated the user **102** using two independent methods: one using a physical validity test (using the mobile device **204**) and the other using a traditional financial validity test (using the transaction handler **106**).

Any thief wishing to fake the identity of the user **102** will have to compromise not only the account number, name, and ASVI, but also physically compromise the mobile device **204**. The knowledge of the mobile identifier, M, or the data string cannot help the thief, because the data string changes with every transaction, i.e., it is unique for each transaction. Thus, vendors **104** can rely on the physical proximity of the mobile device **204** to their owners (user **102**) in order to verify their identity by an additional, independent means.

For example, a user walks into a Starbucks and uses a credit card to purchase a coffee drink. The user gives his name and cell phone number to the cashier and quickly receives a text message from his cell phone provider with the code "9945". The cashier also receives "9945" on the cash register machine. The user tells the cashier the code so that the cashier knows that the user is the same person associated with the cell phone number. The cashier sends the user's name, credit card number, and other information to the credit card company and completes the sale in the usual way.

Now, suppose the user drops his credit card on the way out and a thief picks it up and goes to the Starbucks counter and attempts to use the user's credit card number for a purchase. The cashier asks the thief for his name and cell phone number. If the thief gives the user's cell phone number, then the thief will not receive the message, because the user is in possession of the cell phone. If the thief gives his own name and his own cell phone number, his name and cell phone number are not going to match the name on the credit card during authentication. If the user gives the stolen name, stolen credit card information and his own cell phone number, then the name and phone number will fail verification by the service provider. Thus, a thief cannot fake either the user's name and the user's cell phone number or both and expect to get away with it. A fraudulent transaction will fail either at the service provider **202** or the transaction handler **106** so, the vendor **104** has two opportunities to detect the fraud.

Electronic commerce transactions can also be handled in a similar manner. When a user's purchase information is stolen and misused by someone else, the coupling of the mobile device identity with the financial information prevents misuse and financial fraud.

This exemplary embodiment provides a different authentication mechanism **200** that allows a service provider **202** to give a data string **210** to a mobile device **204** to control the mobile device **204** in response to a request from a vendor **208**, from whom the user **102** requests some service in exchange for a payment. Communication of the data string, rand, to the mobile device **204** can be performed via a data channel or a control channel. In general, messaging involving the mobile device **204** may be over a data channel or a control channel. The data channel may be used for a text message, voice prompt, multimedia message and the like. In one embodiment, messages are presented on the mobile device **204** with a menu for authentication and verification services. Some examples of messages include short message service (SMS), text, instant messaging, video messaging, multi-media messaging, voice-activated speech, human confirmation and the like. Messages over a control channel have separate signaling. The control channel may be a dedicated control channel.

FIG. **3** shows another exemplary embodiment of a method for authentication and verification services for third party vendors using mobile devices. This exemplary embodiment performs a similar set of transactions, but here the service provider **202** sends the data string only to the mobile device **204** and this information is given to the vendor **104** by the user **102**, who receives it on his mobile device **204**. The first and second steps **302**, **304** are the same as those **206**, **208** in FIG. **2**. In the third step **308**, the service provider **202** sends the data string to the user **102** directly. Then, the user **102** sends the data string to the vendor **104** (step 4 **308**), who forwards it to the service provider **202** (step 5 **310**) and the service provider verifies whether the data string is correct and notifies the vendor (step 6 **312**). Here, the responsibility for verifying the data string is correct lies with the service provider **202**, rather than the vendor **104**, as in FIG. **2**. The remaining steps **314**, **316** are similar to those **214**, **216** in FIG. **2**.

FIG. **4** shows yet another exemplary embodiment of a method for authentication and verification services for third party vendors using mobile devices. In this exemplary embodiment, in step 0 **402**, the service provider **202** sends a different data string periodically to the mobile device **204** of every registered user **102** in its network. This information is sent by the user **102** (step 1 **404**) as part of the transaction to the vendor **104** in addition to the name, mobile number (M), and ASVI information. The vendor **104** sends the name, mobile number, and ASVI information to the service provider **202** (step 2 **406**) for verification and, upon successful verification (step 3 **408**), proceeds with the rest of the transaction (steps 4 and 5 **410**, **412**). In an alternate embodiment, the user **102** explicitly requests a data string from the service provider **202** before initiating a transaction, eliminating the need for the service provider **202** to periodically generate data strings for all the devices in its network. This exemplary embodiment may be faster (i.e., decreased transaction time) and more efficient than that shown in FIG. **3**, because it has fewer steps (six vs. nine) and less overhead.

Communication between the vendor **104** and the service provider **202** can be either direct or via an authentication

broker (not shown), who handles transactions between numerous vendors and various service providers. The broker can provide services to identify the mapping between a mobile device number (M) and its authentication service provider **202** and route the requests and responses appropriately to the correct vendor **104** and service provider **202**.

The responsibility for authenticating the user lies primarily with the vendor **104**, in the exemplary embodiments shown in FIGS. **1-4**, which reflects practical constraints in the current world of electronic commerce. Vendors are not compensated for fraudulent charges made by compromised credit cards.

One advantage of exemplary embodiments lies in both the ubiquity of mobile devices that are associated with a centrally controlled network and in the fact that mobile devices **204** are carried by nearly everyone, thereby removing the need to carry a separate authentication device, such as a smart card. By separating the mobile device **204** interaction from the financial aspect of the transaction problem, the potential for abuse of stolen mobiles is reduced, because a thief would have to steal the device as well as the financial instrument information (e.g., credit/debit/smart card) and the ASVI for that instrument and user **102**. While the latter information can be centrally stored, the mobile device state cannot be stored in the same place, stolen or replicated successfully by a thief who wants to masquerade as the user **102**.

FIG. **5** shows still another exemplary embodiment of a method for authentication and verification services for third party vendors using mobile devices. This exemplary embodiment illustrates providing verification services and is useful for applications where details about the transaction are available. For example, users **102** can use this service to verify details about the transaction, (e.g., what is being charged to his or her credit card). As part of verifying the identity of the user **102** during a transaction using his or her mobile number, the vendor **104** sends some transaction information, TrDetail, to the service provider **202** (step 2 **502**).

The TrDetail may include information about the vendor **104**, the name of the user making the transaction, the items or services involved in the transaction, the cost of the transaction, or other information related to the transaction. In one embodiment, the message sent in step 3 **504** to the mobile device **204** may server as a receipt for the user **102**.

After authenticating the user **102** via his or her mobile device registration, the service provider **202** sends the TrDetail information to the mobile device **204** (step 3 **504**). The user **102** can cross-check this information and send an okay or fail message back to the service provider **202** about the transaction (step 4 **506**). All messages are identified by an ID number that is unique, at least for each transaction. The ID number is included in each message, enabling the service provider **202** and the vendor **104** to track the progress of the authentication and verification. If the user **102** verifies the transaction (step 4 **506**), then the service provider **202** passes this information to the vendor **104** (step 5 **508**) and the transaction proceeds as before (steps 6 and 7 **510**, **512**). There is no data string involved in this exemplary embodiment.

In one exemplary embodiment, a user→mobile device→service provider→vendor pathway is used to pass the ASVI information to the vendor **104**, as opposed to sending the information directly to the vendor **104**. This advantageously provides two near-independent pathways (independence is either in space or time or both) for transmittal of secure financial information.

Consider a user **102** who has multiple copies of a credit card, one for himself, one for his spouse, and one for each child. This exemplary embodiment enables the user **102** to have some control over what is being charged to the credit card by his spouse and children. The user **102** can maintain possession of the mobile device **204** and, therefore, either approve or disapprove each purchase in step 4 **506**, after receiving the transaction detail information in step 3 **504**.

In another scenario, suppose the user **102** and his spouse share a credit card and each has a different mobile device **204**. The service provider sends the transaction detail message in step 3 **504** to the mobile device **204** owned by the purchaser, or to each mobile device **204** for approval in step 4 **506**, as desired. For example, they might set up the service or account to allow each spouse a veto power over purchases, one spouse may have approval rights for all purchases, or each may approve their own purchases.

FIG. **6** shows an exemplary embodiment of a method for automatic billing services with user verification for third party vendors using mobile devices. A verification service can be used to ensure that users registering for periodic or automatic billing services are notified and billed only upon their verification (at least initially or until a due date), among other applications. In this exemplary embodiment, the vendor **104** uses pre-stored information, which can also include ASVI or can be obtained from the user as part of the verification process. The vendor **104** uses pre-stored information (step 1 **600**) to initiate a periodic or automatic transaction. The user **102** is notified, after having the identity authenticated by the service provider **202** (with the mobile device **204**) of the TrDetail. The rest of the method is similar to the method described with reference to FIG. **5**.

For example, a vendor sends a bill, (e.g., electric or water bill) as transaction detail information in step 3 **604** for approval before debiting your bank account. Receiving a message on the mobile device **204** and pressing OK before a due date is more convenient for the user **102** than logging on to a website or having to write a check.

For example, a vendor sends transaction detail indicating that the user **102** has been billed in step 3 **604** for an automatic billing service (e.g., phone bill). This automatic payment is not dependent on approval. The first time the automatic billing service is set up, approval may be required. Thus, step 4 **606** is optional.

FIG. **7** shows yet another exemplary embodiment of a method for authentication and verification services. In this exemplary embodiment, the authentication and verification services are provided by the transaction handler **106**, instead of the service provider **202**, as in other embodiments. In this embodiment, the service provider **202** can be located at either the payment gateway that routes the information to the appropriate financial network or the company that verifies the credit/debit card information, or the bank that processes the final payment, all of which are represented in FIG. **7** by transaction handler **106**. The methods shown in FIGS. **2**, **3**, **4**, **5**, and **6** can be adapted to this model, where the service provider functions are provided by one of the component entities of the transaction handler **106**. The number of transaction steps in this embodiment is less than if the service provider were an independent entity. The mobile identifier, M, is registered by the user **102** at a time prior to the transaction, such as when the user obtains or activates the credit/debit card, "Num" and stored (in a storage device, such as a database, which is not shown) by the transaction handler **106** in association with the user's information for later verification.

At **702** (step 1), the user **102** sends his name, (optional address), M, Num, and ASVI information to the vendor **104**, who passes it onto the transaction handler **106** at **704** (step 2). At **706** (step 3), the service provider **202** sends the data string, rand, to both the vendor **104** and the user **102**. The data string may be randomly generated. At **708** (step 4), the user provides

the data string to the vendor **104**. At **710** (step 5), the transaction handler **106** provides an okay or fail message based on whether the user information was the same as the registration information stored prior to the transaction. At **712** (step 6), the vendor **104** notifies the user **102** whether the transaction succeed.

In one exemplary embodiment, the mobile device identifier, M, is received by an inquirer, such as the vendor **104**, service provider **202**, or transaction handler **106**. The mobile device identifier is associated with one or more identities and other data (e.g., name, address, account number). The identity is provided for use in authenticating a transaction.

FIG. **8** is a high level block diagram showing a computer. The computer **800** may be employed to implement embodiments of the present invention. The computer **800** comprises a processor **830** as well as memory **840** for storing various programs **844** and data **846**. The memory **840** may also store an operating system **842** supporting the programs **844**.

The processor **830** cooperates with conventional support circuitry such as power supplies, clock circuits, cache memory and the like as well as circuits that assist in executing the software routines stored in the memory **840**. As such, it is contemplated that some of the steps discussed herein as software methods may be implemented within hardware, for example, as circuitry that cooperates with the processor **830** to perform various method steps. The computer **800** also contains input/output (I/O) circuitry that forms an interface between the various functional elements communicating with the computer **800**.

Although the computer **800** is depicted as a general purpose computer that is programmed to perform various functions in accordance with the present invention, the invention can be implemented in hardware as, for example, an application specific integrated circuit (ASIC) or field programmable gate array (FPGA). As such, the process steps described herein are intended to be broadly interpreted as being equivalently performed by software, hardware, or a combination thereof.

The present invention may be implemented as a computer program product wherein computer instructions, when processed by a computer, adapt the operation of the computer such that the methods and/or techniques of the present invention are invoked or otherwise provided. Instructions for invoking the inventive methods may be stored in fixed or removable media, transmitted via a data stream in a broadcast media or other signal bearing medium, and/or stored within a working memory within a computing device operating according to the instructions.

While the foregoing is directed to various embodiments of the present invention, other and further embodiments of the invention may be devised without departing from the basic scope thereof. As such, the appropriate scope of the invention is to be determined according to the claims, which follow.

What is claimed is:

1. An apparatus for authenticating a user transaction with a vendor, a user having a mobile device, the apparatus comprising:

a memory; and

a processor communicatively connected to the memory and configured to execute instructions received from the memory, the processor configured to:

receive, at a mobile service provider, identification information associated with said user and an identifier associated with said mobile device, wherein the received mobile device identifier comprises at least one of a cell phone number, a subscriber identity module (SIM) card number, and an electronic serial number (ESN), and the user identification information comprises one or more of a name and an address of a registered user;

determine, at the mobile service provider, that the received mobile device identifier and user identification information are associated with a mobile device and a corresponding registered user of the mobile service provider, said registered user being associated with a randomized key string adapted to enable the vendor to authenticate said user after receiving said randomized key string from the mobile device;

generate and transmit said randomized key string toward the mobile device according to a periodic schedule; and

transmit said randomized key string toward the vendor in response to receiving from the vendor said mobile device identifier and said user identification information of the registered user of the mobile service provider, said randomized key string transmitted toward said vendor being adapted to enable automatic authentication of said user transaction.

2. The apparatus of claim **1**, wherein the processor is configured to transmit said randomized key string in response to receiving said mobile device identifier and user identification information associated with a registered user of the mobile service provider.

3. The apparatus of claim **1**, wherein the processor is configured to transmit said randomized key string to said mobile device associated with a registered user of the mobile service provider periodically.

4. The apparatus of claim **1**, wherein said randomized key string transmitted toward said vendor is adapted to enable automatic verification of said user.

5. The apparatus of claim **1**, wherein the inquirer is one of a vendor, a service provider, or a transaction handler.

6. The apparatus of claim **1**, wherein the processor is configured to:

verify that an owner of a mobile device identified by the mobile device identifier is associated with the other identifying data.

7. The apparatus of claim **1**, wherein the processor is configured to:

receive the name and the mobile device identifier; and

verify that an owner of the mobile device identified by the mobile device identifier is associated with the received name.

8. The apparatus of claim **1**, wherein the processor is configured to:

send a data string to both the inquirer and the mobile device identified by the mobile device identifier.

9. The apparatus of claim **1**, wherein the processor is configured to transmit the randomized key string toward the vendor and the mobile device upon determining the match between the received and determined other identifying data.

10. An apparatus for authenticating a user transaction with a vendor, a user having a mobile device, the apparatus comprising:

a memory; and

a processor communicatively connected to the memory and configured to execute instructions received from the memory, the processor configured to:

transmit, by the vendor, toward a mobile service provider, identification information associated with said user and an identifier associated with said mobile device, wherein the received mobile device identifier comprises at least one of a cell phone number, a subscriber identity module (SIM) card number, and an

electronic serial number (ESN), and the user identification information comprises one or more of a name and an address of a registered user;

receive, by the vendor, a first data string comprising a randomized key string sent by the mobile service provider in response to receiving from the vendor said mobile device identifier and said user identification information of the registered user of the mobile service provider and determining that the received mobile device identifier and user identification information are associated with a mobile device and a corresponding registered user of the mobile service provider; and

receive, by the vendor, a second data string comprising said randomized key string from the mobile device, wherein a match between the first and the second data strings comprising said randomized key string indicates authenticity of the user participating in the transaction, said randomized key string being assigned to the user and adapted to enable the vendor to automatically authenticate said user, said randomized key string being generated and transmitted by the mobile service provider toward the mobile device according to a periodic schedule.

11. The apparatus of claim **10**, wherein the processor is configured to transmit said randomized key string in response to receiving said mobile device identifier and user identification information associated with a registered user of the mobile service provider.

12. The apparatus of claim **10**, wherein the processor is configured to transmit said randomized key string to said mobile device associated with a registered user of the mobile service provider periodically.

13. The apparatus of claim **10**, wherein said randomized key string transmitted toward said vendor is adapted to enable automatic verification of said user.

14. The apparatus of claim **10**, wherein the inquirer is one of a vendor, a service provider, or a transaction handler.

15. The apparatus of claim **10**, wherein the processor is configured to:

verify that an owner of a mobile device identified by the mobile device identifier is associated with the other identifying data.

16. The apparatus of claim **10**, wherein the processor is configured to:

receive the name and the mobile device identifier; and

verify that an owner of the mobile device identified by the mobile device identifier is associated with the received name.

17. The apparatus of claim **10**, wherein the processor is configured to:

send a data string to both the inquirer and the mobile device identified by the mobile device identifier.

18. The apparatus of claim **10**, wherein the processor is configured to transmit the randomized key string toward the vendor and the mobile device upon determining the match between the received and determined other identifying data.

* * * * *